

High Specific Power Multiple-Cylinder Alpha Free-Piston Stirling Engine, Phase II

Completed Technology Project (2006 - 2008)



Project Introduction

The proposed effort will result in a design of a 30 kWe dual opposed alpha free-piston Stirling engine power conversion system for space applications, and provide proof of concept by the operation of a practical alpha engine. The stepped piston three-cylinder alpha FPSE has shown the highest efficiency and excellent specific power among various engines studied in Phase I. In addition, the three phase electric output of a three-cylinder machine is naturally better in the system context. Thus a high efficiency 15 kWe stepped three-cylinder alpha FPSE will be designed for a 30 kWe dual opposed operation by having two engines connected for perfect balancing in all harmonics. The program minimizes the development risks by combining proven technologies of Sunpower and Global Cooling Manufacturing Inc. (GCM). GCM has achieved the successful operation of a four-cylinder alpha free-piston Stirling cooler.

Anticipated Benefits

Potential NASA Commercial Applications: In addition to the space applications which this proposal addresses directly, there is a significant potential market for commercial power generation, particularly in light of increasing attention to the environmental cost of fuel consumption and the new stringent fuel emissions regulations in some areas of the world. Sunpower licensee MicroGen, for example, has determined a substantial European and worldwide market for household cogeneration devices. Additionally there are numerous opportunities for remote and mobile power generation applications, including the marine market, auxiliary power markets, remote power generation, standby emergency power generation, peaking generation, truck-mounted power, power for oil and gas fields and other exploratory and off-grid sites.



High Specific Power Multiple-Cylinder Alpha Free-Piston Stirling Engine, Phase II

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Organizational Responsibility	1
Primary U.S. Work Locations and Key Partners	2
Project Transitions	2
Project Management	2
Technology Areas	2

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

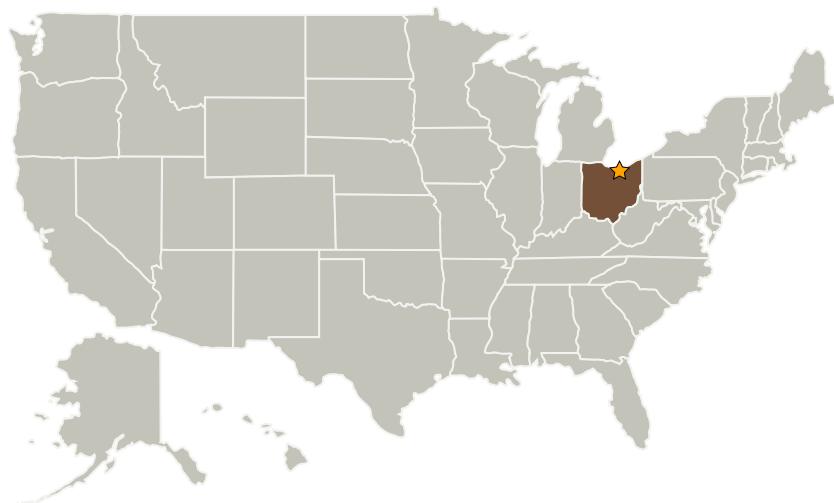
Small Business Innovation Research/Small Business Tech Transfer

High Specific Power Multiple-Cylinder Alpha Free-Piston Stirling Engine, Phase II

Completed Technology Project (2006 - 2008)



Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Sunpower, Inc.	Supporting Organization	Industry	Athens, Ohio

Primary U.S. Work Locations

Ohio

Project Transitions

**December 2006:** Project Start**June 2008:** Closed out**Closeout Summary:** High Specific Power Multiple-Cylinder Alpha Free-Piston Stirling Engine, Phase II Project Image

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Seon-young Y Kim

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
 - └ TX03.1 Power Generation and Energy Conversion
 - └ TX03.1.4 Dynamic Energy Conversion